

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
(Box PCT)  
Washington D.C. 20231  
United States of America

in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 06 May 1996 (06.05.96)	
<b>International application No.</b> PCT/NO95/00183	<b>Applicant's or agent's file reference</b>
<b>International filing date</b> (day/month/year) 09 October 1995 (09.10.95)	<b>Priority date</b> (day/month/year) 12 October 1994 (12.10.94)
<b>Applicant</b> DAGESTAD, Sjur et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

12 April 1996 (12.04.96)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Marie-Claude Taylor</p> <p>Telephone No.: (41-22) 730.91.11</p>
--	--

## PATENT COOPERATION TREATY

PCT

REC'D 05 FEB 1997

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference C78282 BGC/JB	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NO95/00183	International filing date (day/month/year) 09.10.1995	Priority date (day/month/year) 12.10.1994
International Patent Classification (IPC) or national classification and IPC <sub>6</sub> F23Q 13/00, F23G 7/08, F23Q 21/00		
Applicant Techno Consult A.S. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  12.04.1996	Date of completion of this report  15.01.1997
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Anders Bruun Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1994)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

## I. Basis of the report

1. This report has been drawn on the basis of (Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.):

☐ the international application as originally filed.

☒ the description, pages 1-5, as originally filed,  
 pages \_\_\_\_\_, filed with the demand,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☒ the claims, Nos. \_\_\_\_\_, as originally filed,  
 Nos. \_\_\_\_\_, as amended under Article 19,  
 Nos. \_\_\_\_\_, filed with the demand,  
 Nos. 1-6, filed with the letter of 09.10.1996,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☒ the drawings, sheets/fig 1-6, as originally filed,  
 sheets/fig \_\_\_\_\_, filed with the demand  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

**V. Resoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-6</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-6</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-6</u>	YES
	Claims		NO

**2. Citations and explanations**

## Cited documents:

- 1: US 4449920 A (Lerouge et al.)  
2: US 2696875 A (Henwood)  
3: WO 9429648 A1 (Den Norske Stats Oljeselskap A.S.)

The invention relates to a method, an apparatus and an ignition device for igniting combustible gases, for example in the flare of a flare tower. More specifically, it relates to systems in which an pyrotechnic ignition device is launched towards the emitted combustible gas.

The object of the invention is to provide a system in which the control of the activation and detonation of the pyrotechnic ignition devices is improved, and in which an ignition device can be returned after being set in motion.

This is achieved by providing a method (according to claim 1) and an apparatus (according to claim 4) in which the ignition device is propelled through a guidance tube by means of a pressure medium, activated somewhere along its path in the guidance tube and detonated at a predetermined time after the activation, and an ignition device (according to claim 6) to be used with the apparatus of claim 4.

As far as is indicated by the international Search, the claimed inventions are novel.

In the system disclosed by document 1, the ignition devices are launched by explosive charges. Since they are not propelled through a tube, they can not be activated or returned after being set in motion.

.../...

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

In the system disclosed by document 2, an igniting flare is propelled by a pressure medium through a guiding tube to a pilot burner. The flare can not be activated during its path in the tube, and can not be considered to be launched.

Since the cited documents show little relationship with the claimed inventions, and do not give any indication towards them, the claimed inventions cannot be considered obvious. The industrial applicability of the inventions is obvious. Claims 2, 3 and 5 are dependent on claims 1 or 4, and therefore also fulfil the criteria of novelty, inventive step and industrial applicability.

NO 932017 A (corresponding to document 3) is mentioned as prior art in the description of the present application. This document has an earlier priority date than the present application, but was published after the priority date of the present application. In the system disclosed by this document, the pyrotechnic ignition devices are launched by gas pressure in a launching tube and detonated by hitting a target plate in the vicinity of the emitted gas.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

## VI. Certain documents cited

## 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
WO 942968 A1	22.12.1994	30.05.1994	03.06.1993

## 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day/month/year)Date of written disclosure  
referring to non-written disclosure  
(day/month/year)

Amended Patent Claims

1.

5 A method for igniting combustible gases (1), for example from  
a flare (2) of a flare tower (3), where an ignition device  
(4) is launched in a direction toward a region of combustible  
gas (1), said ignition device (4) being propelled by means of  
a pressure medium through a guidance tube (6) to said gas  
cloud region (1), the ignition device (4) undergoing a  
10 reaction for the purpose of active ignition of the gas in  
said region, the time for its activation and reaction being  
predetermined and adapted to the particular flare and  
application, and the ignition device (4) being reacted in the  
form of a shower or cloud of sparks, where at least parts of  
15 the shower of sparks strike the gas cloud (1).

c h a r a c t e r i z e d i n that the ignition device (4)  
is activated somewhere along its path in the tube (6),  
possibly at the moment when the ignition device (4) leaves  
the tube (6) or possibly when the ignition device (4) starts  
20 its course through the tube (6).

2.

A method according to claim 1,  
c h a r a c t e r i z e d i n that the ignition device (4)  
25 is positioned within a trapping device (20) prior to the  
reaction of the ignition device (4).

3.

A method according to claim 1 or 2,  
c h a r a c t e r i z e d i n that the ignition device (4)  
30 may be propelled at a moderate speed through the guidance  
tube (6), that it may optionally be stopped during its  
passage through the tube (6), and that it may optionally be  
reversed and returned back into the guidance tube (6) without  
35 a reaction taking place.

4.

An apparatus to be used for igniting combustible gases (1), for example from a flare (2) of a flare tower (3), by means of an ignition device (4) which is brought toward a region in or near a cloud of gas (1), comprising a guidance tube (6) and a supply of a pressure medium, where the ignition device (4) is adapted for propulsion through the guidance tube (6) by means of the pressure medium for the purpose of bringing the ignition device (4) close to the cloud of gas (1) for reaction near or within the cloud of gas (1), said device further comprising a feeding unit (7), a control device (14) and, optionally, a magazine (8) for the ignition device (4), characterized in that an ignition initiator (13) is mounted somewhere along the guidance tube (6), said initiator (13) activating the ignition device (4) which, after a time delay, undergoes a reaction outside the tube, in or near the cloud of gas (1).

5.

An apparatus according to claim 4, characterized in that it comprises a trapping device (20) for the ignition device (4), which trapping device (20) is situated outside the tube, whereby the ignition device (4) is positioned within the trapping device (20) prior to the reaction of the ignition device (4).

6.

An ignition device to be used with the apparatus according to claims 4 or 5,

characterized in that the ignition device is in the form of an ignition pellet (4) which is electrically or mechanically activated, said activation occurring somewhere along its path in the tube (6), possibly at the moment when the ignition pellet (4) leaves the tube (6), possibly when the ignition pellet (4) starts its course through the tube (6), said ignition pellet (4) having a built-in delay prior to its reaction, and the time for its



10

activation and delay being predetermined and adapted to the particular flare and application.

5

10

15

20

25

30

35

**AMENDED SHEET**

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference C78282 BGC/JB	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NO95/00183	International filing date (day/month/year) 09.10.1995	Priority date (day/month/year) 12.10.1994
International Patent Classification (IPC) or national classification and IPC <sub>6</sub> F23Q 13/00, F23G 7/08, F23Q 21/00		
Applicant Techno Consult A.S. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  12.04.1996	Date of completion of this report  15.01.1997
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM	Authorized officer  Anders Bruun Telephone No. 08-782 25 00
Facsimile No. 08-667 72 88	

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

## I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☐ the international application as originally filed.

☒ the description, pages 1-5, as originally filed,  
pages \_\_\_\_\_, filed with the demand,  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☒ the claims, Nos. \_\_\_\_\_, as originally filed,  
Nos. \_\_\_\_\_, as amended under Article 19,  
Nos. \_\_\_\_\_, filed with the demand,  
Nos. 1-6, filed with the letter of 09.10.1996,  
Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☒ the drawings, sheets/fig 1-6, as originally filed,  
sheets/fig \_\_\_\_\_, filed with the demand  
sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>1-6</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-6</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-6</u>	YES
	Claims		NO

## 2. Citations and explanations

## Cited documents:

- 1: US 4449920 A (Lerouge et al.)  
2: US 2696875 A (Henwood)  
3: WO 9429648 A1 (Den Norske Stats Oljeselskap A.S.)

The invention relates to a method, an apparatus and an ignition device for igniting combustible gases, for example in the flare of a flare tower. More specifically, it relates to systems in which an pyrotechnic ignition device is launched towards the emitted combustible gas.

The object of the invention is to provide a system in which the control of the activation and detonation of the pyrotechnic ignition devices is improved, and in which an ignition device can be returned after being set in motion.

This is achieved by providing a method (according to claim 1) and an apparatus (according to claim 4) in which the ignition device is propelled through a guidance tube by means of a pressure medium, activated somewhere along its path in the guidance tube and detonated at a predetermined time after the activation, and an ignition device (according to claim 6) to be used with the apparatus of claim 4.

As far as is indicated by the international Search, the claimed inventions are novel.

In the system disclosed by document 1, the ignition devices are launched by explosive charges. Since they are not propelled through a tube, they can not be activated or returned after being set in motion.

.../...

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

In the system disclosed by document 2, an igniting flare is propelled by a pressure medium through a guiding tube to a pilot burner. The flare can not be activated during its path in the tube, and can not be considered to be launched.

Since the cited documents show little relationship with the claimed inventions, and do not give any indication towards them, the claimed inventions cannot be considered obvious. The industrial applicability of the inventions is obvious. Claims 2, 3 and 5 are dependent on claims 1 or 4, and therefore also fulfil the criteria of novelty, inventive step and industrial applicability.

NO 932017 A (corresponding to document 3) is mentioned as prior art in the description of the present application. This document has an earlier priority date than the present application, but was published after the priority date of the present application. In the system disclosed by this document, the pyrotechnic ignition devices are launched by gas pressure in a launching tube and detonated by hitting a target plate in the vicinity of the emitted gas.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO95/00183

## VI. Certain documents cited

## 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
WO 942968 A1	22.12.1994	30.05.1994	03.06.1993

## 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day/month/year)Date of written disclosure  
referring to non-written disclosure  
(day/month/year)

**PCT****REQUEST**

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

**PCT/NO 95 / 00183****- 9 OKT. 1995**

International Filing Date

(09.10.95)

*Patentstyret*

STYRET FOR DET INDUSTRIELLE RETTSSVERN

PCT INTERNATIONAL APPLICATION

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum)

<b>Box No. I TITLE OF INVENTION</b> METHOD, APPARATUS AND IGNITION DEVICE FOR IGNITION OF INFLAMMABLE GASES FROM A FLARE ON E.G. A FLAME TOWER.	
<b>Box No. II APPLICANT</b>	
Name and address: <i>(Family name followed by given name, for a legal entity, full official designation. The address must include postal code and name of country.)</i>  Techno Consult A.S. Arnold Haukelands pl. 10 N-1300 SANDVIKA, NORWAY	<input type="checkbox"/> This person is also inventor.  Telephone No. 67571800  Facsimile No. 67571849  Teleprinter No.
State (i.e. country) of nationality: NORWAY	State (i.e. country) of residence: NORWAY
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<b>Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)</b>	
Name and address: <i>(Family name followed by given name, for a legal entity, full official designation. The address must include postal code and name of country.)</i>  DAGESTAD, Sjur Michel Nielsens vei 8 N-0871 OSLO, NORWAY	This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (i.e. country) of nationality: NORWAY	State (i.e. country) of residence: NORWAY
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.	
<b>Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE</b>	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative	
Name and address: <i>(Family name followed by given name, for a legal entity, full official designation. The address must include postal code and name of country.)</i>  COWARD, Bjarne G. BRYNS PATENTKONTOR A/S P.O. Box 765, Sentrum N-0106 OSLO, NORWAY	Telephone No. 22421990  Facsimile No. 22422354  Teleprinter No.
<input type="checkbox"/> Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

## Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

ØDEMARK, Tom  
 Wilh. Wilhelmsens vei 39  
 N-1347 HOSLE, NORWAY

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

NORWAY

State (i.e. country) of residence:

NORWAY

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.



Box No. V DESIGNATION STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

- ☒ AP ARIPO Patent: KE Kenya, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, DE Germany, DK Denmark, ES Spain, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> MD Republic of Moldova      |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> MG Madagascar               |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> MN Mongolia                 |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MW Malawi                   |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MX Mexico                   |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> NO Norway                   |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> NZ New Zealand              |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> PL Poland                   |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> PT Portugal                 |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> RO Romania                  |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> RU Russian Federation       |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> SD Sudan                    |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> SE Sweden                   |
| <input checked="" type="checkbox"/> EE Estonia                               | <input checked="" type="checkbox"/> SG Singapore                |
| <input checked="" type="checkbox"/> ES Spain                                 | <input checked="" type="checkbox"/> SI Slovenia                 |
| <input checked="" type="checkbox"/> FI Finland                               | <input checked="" type="checkbox"/> SK Slovakia                 |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> TJ Tajikistan               |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TM Turkmenistan             |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> TT Trinidad and Tobago      |
| <input checked="" type="checkbox"/> IS Iceland                               | <input checked="" type="checkbox"/> UA Ukraine                  |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> UG Uganda                   |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> UZ Uzbekistan               |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> VN Viet Nam                 |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |   |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |   |
| <input checked="" type="checkbox"/> LK Sri Lanka                             |   |
| <input checked="" type="checkbox"/> LR Liberia                               |   |
| <input checked="" type="checkbox"/> LT Lithuania                             |   |
| <input checked="" type="checkbox"/> LU Luxembourg                            |   |
| <input checked="" type="checkbox"/> LV Latvia                                |   |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ MK The former Yugoslav Republic of Macedonia
- ☒ AL Albania

In addition to the designations made above, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except the designation(s) of

The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Box No. VI **PRIORITY CLAIM**Further priority claims are indicated in the Supplemental Box ☐

The priority of the following earlier application(s) is hereby claimed

Country (in which or for which the application was filed)	Filing Date (day/month/year)	Application No.	Office of filing (only for regional or international application)
item (1)  NORWAY	(12.10.94) 12. October 1994	943851	
item (2)			
item (3)			

Mark the following check-box if the certified copy of the earlier application is to be issued by the Office which for the purposes of the present international application is the receiving Office (a fee may be required):

☒ The receiving Office is hereby requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s): 1)Box No. VII **INTERNATIONAL SEARCHING AUTHORITY**

Choice of International Searching Authority (ISA) (If two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): ISA / SE

Earlier search Fill in where a search (international, international-type or other) by the International Searching Authority has already been carried out or requested and the Authority is now requested to base the international search, to the extent possible, on the results of that earlier search. Identify such search or request either by reference to the relevant application (or the translation thereof) or by reference to the search request:

Country (or regional Office): Date (day/month/year): Number:

Box No. VIII **CHECK LIST**

This international application contains the following number of sheets:

1. request : 4 sheets  
2. description : 5 sheets  
3. claims : 2 sheets  
4. abstract : 1 sheet  
5. drawings : 3 sheets

Total : 15 sheets

This international application is accompanied by the item(s) marked below:

1. ☐ separate signed power of attorney  
2. ☐ copy of general power of attorney  
3. ☐ statement explaining lack of signature  
4. ☐ priority document(s) identified in Box No. VI as item(s):  
5. ☒ fee calculation sheet  
6. ☐ separate indications, concerning deposited microorganisms  
7. ☐ nucleotide and/or amino acid sequence listing (diskette)  
8. ☒ other (specify):

Copy of Official Action.

Figure No. 1 of the drawings (if any) should accompany the abstract when it is published.

Box No. IX **SIGNATURE OF APPLICANT OR AGENT**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

25.09.95 **TECHNO CONSULT**  
Arne Øie Managing Director (Arne Øie)

Sjor Dagstad  
Sjor Dagstad  
Tom Ødemark

For receiving Office use only		2. Drawings: <input checked="" type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:	- 9 OKT. 1995 (09.10.95)	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority specified by the applicant: ISA/SE	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid	

Date of receipt of the record copy by the International Bureau:

For International Bureau use only

09 NOVEMBER 1995 (09.11.95)

**FREMANGSMÅTE, ANORDNING OG TENNORGAN FOR ANTENNELSE AV  
BRENNBARE GASSER FOR EKSEMPEL FRA EN FAKKEL PÅ ET  
FLAMMETÅRN.**

Foreliggende oppfinnelse vedrører en fremgangsmåte, anordning og tennorgan for antennelse av brennbare gasser for eksempel fra en fakkell på et flammeltårn, der et tennorgan settes i bevegelse i retning mot et område med en brennbar gass.

Ved antennelse av gassstrømmer f.eks. i en fakkell, kan det skilles mellom to forskjellige antennelsesmekanismer. Den ene mekanismen er et såkalt punkttenningssystem, hvor gassen antennes kun i ett punkt. Dette kan oppnås ved bruk av for eksempel en fyrstikk, pilotbrenner eller en flammefrontgenerator. Punkttenningen forutsetter at gassen ved antennelsespunktet har en konsentrasjon mellom nedre og øvre eksplosjonsgrense. Den andre mekanismen er et såkalt volumtenningssystem, hvor gassen tennes ved at det spres gnister i et stort volum og som antenner gassen i dette volumet. Den siste mekanismen er derved mye mer pålitelig enn punkttenningssystemet.

Fra norsk patentesøknad nr. 932017 er det kjent en fremgangsmåte til antennelse av brennbar gass som slippes ut gjennom en fakkell i et flammeltårn. Tennorganet er i form av et prosjektil, som skytes ut i en bane i retning mot gassutslippet. Tennorganet støter mot en anslagsplate som er anordnet ved gassutslippsstedet, hvorved tennorganet detonerer og bringer en strøm av glødende partikler inn i gassstrømmen, som derved antennes. Tennorganet detonerer altså ved anslag. Denne fremgangsmåten er beheftet med en rekke ulemper, blant annet ved at utstyret som anvendes er uforholdsmessig komplisert. En av årsakene til dette er at tennorganet skytes ut ved hjelp av et meget høyt drivgasstrykk i form av en gasspuls, med et trykk i størrelsesorden 260-300 bar. Måten tennorganet skytes ut på, gjør det ikke mulig å stanse tennorganet når det først er satt i bevegelse, og det er heller ikke mulig å returnere tennorganet tilbake til utskytningsanordningen.

Denne kjente løsningen anvender et såkalt varerør med klaring mellom tennbrikken (prosjektilet) og løpet. All energien til tennbrikken tilføres før den kommer inn i varerøret (det vil si et vanlig skudd med høyt trykk).

En hensikt med foreliggende oppfinnelse er å tilviebringe en fremgangsmåte, anordning og tennbrikke for antennelse av gasser i et flammeltårn som ikke er beheftet med ulemperne beskrevet over.

En annen hensikt med foreliggende oppfinnelse er å tilviebringe en anordning for antennelse av gasser, hvor tennbrikken ikke skytes ut med stort trykk, men som føres ut av et utskytningsrør med en kontinuerlig drivgasstilførsel.

En annen hensikt med oppfinnelsen er å tilveiebringe en programmerbar tennbrikke, som kan stanses etter at den er satt i bevegelse og som kan returneres til utskytningsanordningen.

Nok en hensikt med foreliggende oppfinnelse er å tilveiebringe en tennbrikke som armeres under sin bevegelse fra utskytningsanordningen til fakkelen ved hjelp av en elektrisk eller mekanisk anordning som starter/armerer tennbrikken.

Det som spesielt oppnås ved foreliggende oppfinnelse i forhold til den kjente løsningen, er at det oppnås en kontrollert og lavere hastighet på tennbrikken. Dette medfører at det er påkrevet med en mindre sikkerhetssone rundt anordningen og dette vil også bety en redusert fare for eventuell helikoptertrafikk i nærheten av flammetårnet. Sammenlignet med den kjente løsningen vil foreliggende oppfinnelse medføre langt lavere investeringskostnader bl.a. fordi det kun er ett trykknivå på drivgasssystemet og det kan anvendes flere standardkomponenter enn ved den kjente løsningen. Foreliggende oppfinnelse er også mer fleksibel enn den kjente løsningen ved at den kan tilpasses alle typer fakler.

Dette oppnås ved en fremgangsmåte ved antennelse av gasser i flammetårn eller fakkel der et tennorgan settes i bevegelse i retning mot et område av en brennbar gass, i henhold til oppfinnelse, som er kjennetegnet ved at tennorganet drives ved hjelp av et trykkmedium gjennom et føringsrør til nevnte gass-skyområde, at tennorganet omsettes for aktiv antennelse av gassen i nevnte område, idet tidspunktet for armering og omsetning er forhåndsbestemt og tilpasset den enkelte fakkel og applikasjon.

Tennorganet omsettes fortrinnsvis i form av et gnistregn eller sky av gnister hvor i det minste deler av gnistregnet treffer gass-skyen.

Tennorganet armeres fortrinnsvis et sted langs banen i røret, eventuelt i det øyeblikk tennorganet forlater røret, eventuelt idet tennorganet starter sitt løp i røret, eventuelt ved at tennorganet treffer et objekt (anslagsplate) ved fakkelen.

Tennorganet anbringes eventuelt i et oppfangingsorgan før tennorganet omsettes.

Tennorganet kan drives med en moderat hastighet i føringsrøret, det kan eventuelt stoppes underveis i røret og det kan eventuelt reverseres og returneres tilbake i føringsrøret uten at omsetning opptrer.

Oppfinnelsen omfatter også en anordning til bruk ved antennelse av gasser i flammetårn eller

- 5 fakkel ved hjelp av et tennorgan som bringes mot et område i eller nær en gass-sky, som er kjennetegnet ved et føringsrør og en trykkmedium-kilde, der tennorganet er innrettet for drift gjennom føringsrøret ved hjelp av trykkmediet i den hensikt å bringe tennorganet nær gass-skyen for omsetning ved eller i gass-skyen.
- 10 Anordning innbefatter fortrinnsvis en mateenhet, et styringsorgan og eventuelt et magasin for tennorganet.
- En antennelses-starter er fortrinnsvis anordnet på et eller annet sted langs føringsrøret, hvilken starter/armerer tennorganet som, etter en tidsforsinkelse, omsettes i det fri i eller nær
- 15 gass-skyen.
- Anordning innbefatter eventuelt et oppfangingsorgan for tennorganet etter at det har forlatt røret.
- 20 Oppfinnelsen omfatter også et tennorgan for bruk med anordningen, som er kjennetegnet ved at det er i form av en tennbrikke som blir armert elektrisk eller mekanisk, der tennbrikken har innbygget en forsinkelse før den omsettes, idet armeringstidspunktet og forsinkelsen er forhåndsbestemt og tilpasset den enkelte fakkel og applikasjon.
- 25 Oppfinnelsen vil i det etterfølgende bli mer detaljert beskrevet med henvisning til de medfølgende tegninger.
- Figur 1 viser en fakkel med en anordning for antennelse av gass i henhold til foreliggende
- 30 oppfinnelse.
- Figur 2 viser skjematisk en mateenhet og startsentral i henhold til foreliggende oppfinnelse.
- Figur 3 viser en utførelsesform av den øvre enden av anordningen i henhold til foreliggende
- 35 oppfinnelse.
- Figur 4 viser en annen utførelsesform av den øvre enden av anordningen i henhold til foreliggende oppfinnelse.
- 40 Figur 5 viser en utførelsesform av et tennrør/elektrisk starter i henhold til foreliggende oppfinnelse.

- 5 Figur 6 viser en utførelsesform av en elektrisk tennbrikke i henhold til foreliggende oppfinnelse.

10 I figur 1 er det vist prinsippet ved antennelse av en gasstrøm 1 ved en fakkell 2 ved enden av et flammetårn 3. En tennbrikke 4 hentes fra et forråd (f.eks. et magasin), lades inn i en startsentral 5, presses ut ved hjelp av et s.k. rørpostsystem gjennom et tennrør 6, omsettes ved enden av fakkelen 2 og danner en sky av gnister som antenner gassstrømmen 1 ved fakkelen 2. Tennbrikken 4 er ført i tennrøret 6 og vil hele tiden ligge an mot rørvæggen som styrer og tetter. Brikken 4 skytes altså ikke ut slik det er tilfelle med den kjente anordningen.

15 I figur 2 er hovedkomponentene til anordningen vist mer detaljert. Startsentralen 5 innbefatter en mateenhet 7 og et magasin 8 for tennbrikker 4. Startsentralen 5 er forbundet med tennrøret 6 ved hjelp av en ventil 9. Tennrøret 6 er forbundet med en drivgassstilførsel 12 ved hjelp av en ventil 10 og en reservoartank 11. Startsentralen 5 er også forbundet med et styresystem 14.

20 Dersom anordningen skal anvendes med elektrisk eller mekanisk armerbare tennbrikker 4, er det på tennrøret 6 anbragt en mekanisk eller elektrisk starter 13. Hensikten med denne starteren 13 vil bli beskrevet mer detaljert senere.

25 Tenningen foregår ved at en tennbrikke 4 hentes ut fra magasinet 8 og lades inn i startsentralen 5.

Fra startsentralen 5 vil tennbrikken 4 bli presses ut ved hjelp av en drivgass f.eks. trykkluft, med et trykk i størrelsesorden 0 til 20 bar og videre inn i et rørsystem 6. Etter at tennbrikken har passert ut fra sentralen 5 vil denne stenges av ved at ventilen 9 stenges. Ytterligere drivgass tilføres ved at ventilen 10 åpnes og slipper drivgass, f.eks. trykkluft, inn i røret 6 bak tennbrikken 4. Ventilen 10 er forbundet med en drivgassstilførsel 12 som eventuelt er forbundet med en drivgassstank 11. Tennbrikken 4 vil deretter bli presset frem gjennom rørsystemet 6 etter rørpostprinsippet. Tennbrikkens 4 bevegelse i røret 6 kan stanses og tennbrikken 4 kan eventuelt hentes tilbake til sentralen 5 ved hjelp av undertrykk dersom dette er ønskelig.

35 Tennbrikken 4 kan armeres enten elektrisk eller mekanisk. Ved bruk av elektrisk armerbare tennbrikker 4 vil disse passere en armeringsenhet 13 som f.eks. består av to kontakter. Her tilføres en elektrisk impuls til tennbrikken og en elektrisk tenner vil starte. Dette er vist i figurene 2, 5 og 6. Tennbrikken 4 kan f.eks. være utformet med en ytre kappe 15 og styrebånd 16 som vil ligge an mot røret 6 og hindre at drivgass lekker forbi tennbrikken 4.

40 Dette er vist på venstre side av figur 6. Den ytre kappen 15 kan være elektrisk ledende og være forbundet med en tenner 18 inne i tennbrikken. Dette er vist på høyre side av figur 6.

- 5 Innmaten i tennbrikken 4 består av en brannsats 17, en tenner 18 og et gnistdannende medium 19. Tenneren 18 kan være forhåndsprogrammert til å gå av etter en viss tidsperiode.

Dersom tennbrikken 4 er av en mekanisk armerbar type, vil det ikke være nødvendig med armeringsenheten 13. Når tennbrikken 4 hentes fra magasinet 8, vil brikken 4 klargjøres ved  
10 at sikringen fjernes. Tennbrikken 4 sendes deretter inn i tennrøret 6. Når brikken 4 forlater tennrøret 6, startes brikken ved at den mekaniske sikringen går av. Dette kan løses f.eks. ved hjelp av en armering av håndgranattypen. Tennbrikken er programmert til å inneha en tidsforsinkelse og kan omsettes enten midt inne i gasskyen eller i en kurv.

- 15 I figurene 3 og 4 er det vist to forskjellige måter tennbrikken 4 kan omsettes på. Tennbrikken 4

kan enten som vist i figur 3 fortsette i en fri bane inn i gasskyen 1 etter at den har forlatt tennrøret 6. Tennbrikken 4 er programmert slik at den omsettes når den er midt inne i gasskyen 1. Den andre muligheten er at tennbrikken 4 lander i en kurv etter at den har forlatt  
20 tennrøret 6, som vist i fig. 4. Brikken blir da liggende i en kurv 20 inntil den omsettes. Det stilles lavere krav til presisjon med hensyn til tenningstidspunkt ved denne løsningen. Kurven 20 er utformet slik at gnistene vil spres i et gunstigst mulig område med hensyn til antennelse av gasskyen 1.

- 25 Foreliggende oppfinnelse kan også anvende vanlige tennbrikker 4 som omsettes ved anslag. Det kan i dette tilfelle anvendes et ca. 100 m langt rør og et lavt drivgasstrykk i størrelsesorden 10 - 20 bar. Siden tennbrikken 4 omsettes ved anslag, må det anordnes en anslagsplate (ikke vist) ved utløpet av tennrøret 6.

30

35

5 Patentkrav

1.

10 Fremgangsmåte ved antennelese av brennbare gasser (1) for eksempel fra en fakkel (2) på et flammertårn (3), der et tennorgan (4) settes i bevegelse i retning mot et område av en brennbar gass (1), k a r a k t e r i s e r t v e d at tennorganet (4) drives ved hjelp av et trykkmedium gjennom et føringsrør (6) til nevnte gass-skyområde (1), at tennorganet (4) omsettes for aktiv antennelese av gassen i nevnte område, idet tidspunktet for armering og omsetning er forhåndsbestemt og tilpasset den enkelte fakkel og applikasjon.

15 2.

Fremgangsmåte ifølge krav 1, k a r a k t e r i s e r t v e d at tennorganet (4) omsettes i form av et gnistregnet eller sky av gnister hvor i det minste deler av gnistregnet treffer gass-skyen (1).

20 3.

Fremgangsmåte ifølge krav 1 eller 2, k a r a k t e r i s e r t v e d at tennorganet (4) armeres et sted langs banen i røret (6), eventuelt i det øyeblikk tennorganet (4) forlater røret (6), eventuelt idet tennorganet (4) starter sitt løp i røret (6), eventuelt ved at tennorganet (4) treffer et objekt ved fakkelen (2).

25

4.

Fremgangsmåte ifølge krav 1,2 eller 3, k a r a k t e r i s e r t v e d at tennorganet (4) anbringes i et oppfangingsorgan (20) før tennorganet (4) omsettes.

30 5.

Fremgangsmåte ifølge krav 1,2,3 eller 4, k a r a k t e r i s e r t v e d at tennorganet (4) kan drives moderat i føringsrøret (6), at det eventuelt kan stoppes underveis i røret (6) og at det eventuelt kan reverseres og returneres tilbake i føringsrøret (6) uten at omsetning opptrer.

35 6.

Anordning til bruk ved antennelese av brennbare gasser (1) for eksempel fra en fakkel (2) på et flammertårn (3), ved hjelp av et tennorgan (4) som bringes mot et område i eller nær en gass-sky (1), k a r a k t e r i s e r t v e d et føringsrør (6) og en trykkmedium-kilde, der tennorganet (4) er innrettet for drift gjennom føringsrøret (6) ved hjelp av trykkmediet i den hensikt å bringe tennorganet (4) nær gass-skyen (1) for omsetning ved eller i gass-skyen (1).

40



- 5 7. Anordning ifølge krav 6, karakterisert ved at den innbefatter en mateenhet (7), et styringsorgan (14) og eventuelt et magasin (8) for tennorganet (4).
- 8.
- 10 Anordning ifølge krav 6 eller 7, karakterisert ved at en antenneses-starter (13) er anordnet på et eller annet sted langs føringsrøret (6), hvilken starter (13) armerer tennorganet (4) som, etter en tidsforsinkelse, omsettes i det fri i eller nær gass-skyen (1).
- 9.
- 15 Anordning ifølge krav 6,7 eller 8, karakterisert ved at den innbefatter et oppfangingsorgan (20) for tennorganet (4) etter at det har forlatt røret (6).
- 10.
- 20 Tennorgan for bruk med anordningen ifølge krav 6-9, karakterisert ved at det er i form av en tennbrikke (4) som blir armert elektrisk eller mekanisk, der tennbrikken (4) har innebygget en forsinkelse før den omsettes, idet armeringstidspunktet og forsinkelsen er forhåndsbestemt og tilpasset den enkelte fakkell og applikasjon.

5 Sammendrag

Det er beskrevet en fremgangsmåte, anordning og tennbrikke for antennelse av brennbare gasser (1) for eksempel fra en fakkell (2) på et flammetårn (3), hvor en tennbrikke (4) settes i bevegelse i retning mot et område av en brennbar gass, kjennetegnet at tennorganet (4) drives ved hjelp av et trykkmedium gjennom et føringsrør (6) til nevnte gass-skyområde, at tennorganet (4) omsettes for aktiv antennelse av gassen i nevnte område, idet tidspunktet for armering og omsetning er forhåndsbestemt og tilpasset den enkelte fakkell og applikasjon. Tennorganet (4) omsettes i form av et gnistregn eller sky av gnister hvor i det minste deler av gnistregnet treffer gass-skyen tennorganet (4) armeres et sted langs banen i røret (6), eventuelt i det øyeblikk tennorganet (4) forlater røret (6), eventuelt idet tennorganet (4) starter sitt løp i røret (6), eventuelt ved at tennorganet (4) treffer et objekt ved fakkelen (2). Tennorganet (4) anbringes eventuelt i et oppfangingsorgan før tennorganet (4) omsettes. Tennorganet (4) kan drives moderat i føringsrøret (6), kan eventuelt stoppes underveis i røret (6) og kan eventuelt reverseres og returneres tilbake i føringsrøret (6) uten at omsetning opptrer.

25 Figur 1.



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>F23Q 13/00, F23G 7/08, F23Q 21/00</b>		A1	(11) International Publication Number: <b>WO 96/12142</b>
			(43) International Publication Date: 25 April 1996 (25.04.96)
(21) International Application Number: PCT/NO95/00183		(51) Designated States: AL, AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).	
(22) International Filing Date: 9 October 1995 (09.10.95)			
(30) Priority Data: 943851 12 October 1994 (12.10.94) NO			
(71) Applicant (for all designated States except US): TECHNO CONSULT A/S [NO/NO]; Arnold Haukelands pl. 10, N-1300 Sandvika (NO).			
(72) Inventors; and			
(75) Inventors/Applicants (for US only): DAGESTAD, Sjur [NO/NO]; Michel Nielsens vei 8, N-0871 Oslo (NO); ØDEMARK, Tom [NO/NO]; Wilh. Wilhelmsens vei 39, N-1347 Hosle (NO).			
(74) Agent: COWARD, Bjarne, G.; Bryns Patentkontor a/s, P.O. Box 765, Sentrum, N-0106 Oslo (NO).			

## Published

With international search report.

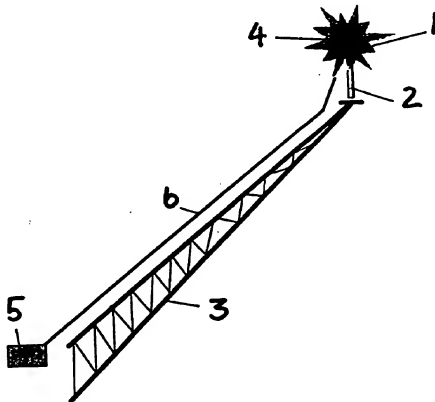
With amended claims.

In English translation (filed in Norwegian).

(54) Title: METHOD, APPARATUS AND IGNITION DEVICE FOR IGNITION OF INFLAMMABLE GASES FROM A FLARE ON E.G. A FLAME TOWER

## (57) Abstract

There are described a method, an apparatus and an ignition pellet for the ignition of combustible gases (1), for example from a flare (2) of a flare tower (3), where an ignition pellet (4) is launched in a direction toward a region of combustible gas, characterized in that the ignition device (4) is propelled by means of a pressure medium through a guidance tube (6) to said gas cloud region, that the ignition device (4) undergoes a reaction for the purpose of active ignition of the gas in said region, the time for its activation and reaction being predetermined and adapted to the particular flare and application. The reaction of the ignition device (4) is in the form of a shower or cloud of sparks where at least parts of the shower of sparks will strike the cloud of gas (1). The ignition device (4) is activated somewhere along its path through the tube (6), possibly at the moment when the ignition device (4) leaves the tube (6), possibly when the ignition device (4) starts its journey through the tube (6), or possibly by the fact that the ignition device (4) strikes an object in the vicinity of the flare (2). The ignition device (4) may be positioned within a trapping device prior to the reaction of the ignition device (4). The ignition device (4) may be propelled through the guidance tube (6) at a moderate speed, may optionally be stopped during its passage through the tube (6) and may optionally be reversed and returned back into the guidance tube (6) without a reaction taking place.



Method, apparatus and ignition device for ignition of inflammable gases from a flare on e.g. a flame tower

The present invention relates to a method, an apparatus and an ignition device for igniting combustible gases, for example from a flare of a flare tower, where an ignition device is launched in a direction toward a region of combustible gas.

With respect to the ignition of gas flows, for example in a flare, a distinction may be made between two different ignition techniques. One technique is a so-called point ignition system, where the gas is ignited only at one point. This can be achieved by means of, for example, a match, a pilot burner or a flame front generator. A prerequisite for point ignition is that the gas at the point of ignition has a concentration between the lower and the upper detonation line. The other technique is a so-called volume ignition system, where ignition occurs through sparks being scattered within a large volume and igniting the gas in this volume. The latter technique is thereby a great deal more reliable than the point ignition system.

The Norwegian Patent Application No. 932017 teaches a method for the ignition of combustible gas emitted through a flare in a flare tower. The ignition device is in the form of a projectile which is fired in a path in the direction toward the gas outlet. The ignition device strikes an impact plate which is mounted at the location of the gas outlet, whereby the ignition device undergoes a reaction and brings a flow of incandescent particles into the gas flow, which is ignited thereby. Thus, the ignition device is detonated by impact. This method is encumbered with a number of inconveniences, inter alia, the fact that the equipment used is excessively complicated. One of the reasons therefor is that the ignition device is fired by means of very high propulsion gas pressure in the form of a gas pulse, having a pressure at

a magnitude of 260-300 bar. The manner in which the ignition device is fired makes it impossible to stop the ignition device after it is launched, nor is it possible to return the ignition device to the launching means. This prior art  
5 solution makes use of a so-called protective tube having a clearance between the ignition pellet (the projectile) and the bore. All the energy for the pellet is supplied before it enters the protective tube (i.e., a normal shot at high pressure).

10

An object of the present invention is to provide a method, an apparatus and an ignition pellet for igniting gases in a flare tower and avoid the disadvantages described above.

15 Another object of the present invention is to provide a device for igniting gases, where the ignition pellet is not launched by high pressure but is guided out of a launching tube which has a continuous supply of propulsion gas.

20 Another object of the invention is to provide a programmable ignition pellet, which may be stopped after it has been set in motion and which may be returned to the launching means.

Yet another object of the present invention is to provide an  
25 ignition pellet which is activated during its movement from the launching means to the flare by means of an electrical or mechanical device which initiates/activates the ignition pellet.

30 That which is particularly achieved by the present invention in relation to the known solution is a controlled and lower speed of the ignition pellet. This entails that the required safety zone surrounding the device can be smaller, and this will also mean that the danger to possible helicopter traffic  
35 near the flare tower will be reduced. Compared with the known solution the present invention will entail far lower investment costs, inter alia because there is only one

pressure level for the propulsion gas system and standard components may be more widely used than in the known solution. The present invention is also more flexible than the known solution by being adaptable to all types of flares.

5

The above objects are achieved by a method for the ignition of gases in a flare tower or flare where an ignition device is launched in a direction toward a region of a combustible gas, which method according to the invention is characterized in that the ignition device is propelled by means of a pressure medium through a guidance tube to said gas cloud region, that the ignition device undergoes a reaction for the purpose of active ignition of the gas in said region, the time for its activation and reaction being predetermined and adapted to the particular flare and application.

15

Preferably, the ignition device undergoes a reaction in the form of a shower or cloud of sparks, where at least parts of the shower of sparks will strike the cloud of gas.

20

Preferably, the ignition device is activated somewhere along its path through the tube, possibly at the moment when the ignition device leaves the tube, possibly when the ignition device starts its journey through the tube, or possibly by the fact that the ignition device strikes an object (impact plate) in the vicinity of the flare.

25

The ignition device may optionally be positioned within a trapping device prior to the reaction of the ignition device.

30

The ignition device may be propelled through the guidance tube at a moderate speed, it may optionally be stopped during its passage through the tube, and it may optionally be reversed and returned back into the guidance tube without a reaction taking place.

35

The invention also comprises an apparatus for the use of igniting gases in a flare tower or flare by means of an ignition device which is brought toward a region in or near a cloud of gas and which is characterized by a guidance tube and a supply of a pressure medium, where the ignition device is adapted for propulsion through the guidance tube by means of the pressure medium for the purpose of bringing the ignition device close to the cloud of gas for a reaction near or within the cloud of gas.

Preferably, the apparatus comprises a feeding unit, a control device and, optionally, a magazine for the ignition device.

Preferably, an ignition initiator is mounted somewhere along the guidance tube so as to initiate/activate the ignition device which, after a time delay, undergoes a reaction outside the tube, in or near the cloud of gas.

Optionally, the apparatus comprises a trapping device for the ignition device after it has left the tube.

The invention also comprises an ignition device for use with the apparatus, said device being characterized in that it is in the form of an ignition pellet which is electrically or mechanically activated, said ignition pellet having a built-in delay prior to its reaction, the time for its activation and delay being predetermined and adapted to the particular flare and application.

In what follows the invention will be described in more detail with reference to the appended drawings.

Figure 1 shows a flare having an apparatus for the ignition of gas according to the present invention.

Figure 2 is a schematic view of a feeding unit and launching means according to the present invention.

Figure 3 shows an embodiment of the upper end of the apparatus according to the present invention.

5 Figure 4 shows another embodiment of the upper end of the apparatus according to the present invention.

Figure 5 shows an embodiment of a activator/electric initiator according to the present invention.

10

Figure 6 shows an embodiment of an electric ignition pellet according to the present invention.

In Figure 1 is shown the principle of igniting a gas flow 1 at a flare 2 at the end of a flare tower 3. An ignition pellet 4 is collected from a supply (for example a magazine), is loaded into a launching means 5, is ejected by means of a so-called pneumatic post system through a guidance tube 6, undergoes a reaction at the end of the flare 2 and forms a cloud of sparks which ignite the gas flow 1 at the flare 2. The ignition pellet 4 is conducted through the guidance tube 6 and will the whole time bear against the tube wall which serves as a guidance and sealing. Thus, the pellet 4 is not fired as it is in the case of the known apparatus.

25

In Figure 2 the main components of the apparatus are shown in more detail. The launching means 5 comprises a feeding unit 7 and a magazine 8 for ignition pellets 4. The launching means 5 is connected to the guidance tube 6 by means of a valve 9. The guidance tube 6 is connected with a propulsion gas supply 12 by means of a valve 10 and a reservoir tank 11. The launching means 5 is also connected with a control system 14. If the apparatus is to be used with electrically or mechanically activatable ignition pellets 4, a mechanical or electric initiator 13 is mounted on the guidance tube 6. The purpose of this initiator 13 will be described in more detail later.

35



The ignition takes place by an ignition pellet 4 being collected from the magazine 8 and loaded into the launching means 5. From the launching means 5 the ignition pellet 4 will be ejected by means of a propulsion gas, for example pressurized air, having a pressure in the magnitude of 0-20 bar, and propelled further into a tube system 6. After the ignition pellet has left the launching means 5, the latter will be closed off because the valve 9 closes. Additional propulsion gas is supplied by the valve 10 opening and admitting propulsion gas, for example pressurized air, into the tube 6 behind the ignition pellet 4. The valve 10 is connected to a propulsion gas supply 12 which optionally is connected with a propulsion gas tank 11. The ignition pellet 4 will thereafter be pressed forward through the tube system 6 in accordance with the pneumatic post principle. The movement of the ignition pellet 4 in the tube 6 may be stopped, and the ignition pellet 4 may optionally be brought back to the launching means 5 by means of negative pressure.

20

The ignition pellet 4 may be either electrically or mechanically activated. When electrically activatable ignition pellets 4 are used, these will pass an activator unit 13 consisting, for example, of two contact pieces. Here an electric impulse is applied to the ignition pellet and an electric igniter will start. This is shown in Figures 2, 5 and 6. The ignition pellet 4 may, for example, be designed with an exterior casing 15 and a guide strip 16 which will bear against the tube 6, preventing the propulsion gas to leak past the ignition pellet 4. This is shown on the left side of Figure 6. The exterior casing 15 may be a conductor carrying current and be connected with an igniter 18 inside the ignition pellet. This is shown on the right side of Figure 6.

35

The interior of the ignition pellet 4 consists of a fire charge 17, an igniter 18 and a spark-forming medium 19. The

igniter 18 may be preprogrammed to go off after a certain period of time.

If the ignition pellet 4 is of a mechanically activatable type, the activator unit 13 is unnecessary. When the ignition pellet 4 is fetched from the magazine 8, the pellet 4 will be activated by the removal of the safety device. The ignition pellet 4 is thereafter sent into the guidance tube 6. When the pellet 4 leaves the guidance tube 6, the pellet is set off by the release of the mechanical safety device. This can be solved, for example, by means of an activator of the hand grenade type. The ignition pellet is programmed for a time delay and may go undergo its reaction either in the middle of the gas cloud or in a basket.

Two different ways in which the reaction of the ignition pellet 4 may occur are shown in Figures 3 and 4, one possibility, as shown in Figure 3, being that the ignition pellet 4 continues in a free path into the cloud of gas 1 after it has left the guidance tube 6. The ignition pellet 4 is programmed so that it undergoes a reaction when it is in the middle of the gas cloud 1. The other possibility is that the ignition pellet 4 lands in a basket after it has left the guidance tube 6, as shown in Figure 4. The pellet will then remain in the basket 20 until its reaction. This solution demands less precision with respect to the time of ignition. The basket 20 is formed so that the sparks will be dispersed in the most favorable area with respect to the ignition of the gas cloud 1.

The present invention may also make use of ordinary ignition pellets 4, the reaction of which occurs by impact. In that case there may be used a tube having a length of about 100 m, and a propulsion gas having a low pressure in the magnitude of 10 - 20 bar. Since the ignition pellets 4 react by impact, an impact plate (not shown) must be mounted at the outlet of the guidance tube 6.

Patent Claims

1.

A method for igniting combustible gases (1), for example from  
5 a flare (2) of a flare tower (3), where an ignition device  
(4) is launched in a direction toward a region of combustible  
gas (1),

characterized in that the ignition device (4)  
is propelled by means of a pressure medium through a guidance  
10 tube (6) to said gas cloud region (1), that the ignition  
device (4) undergoes a reaction for the purpose of active  
ignition of the gas in said region, the time for its  
activation and reaction being predetermined and adapted to  
the particular flare and application.

2.

A method according to claim 1,

characterized in that the reaction of the  
ignition device (4) is in the form of a shower or cloud of  
20 sparks, where at least parts of the shower of sparks will  
strike the cloud of gas (1).

3.

A method according to claim 1 or 2,

characterized in that the ignition device (4)  
is activated somewhere along its path through the tube (6),  
possibly at the moment when the ignition device (4) leaves  
the tube (6), possibly when the ignition device (4) starts  
its journey through the tube (6), or possibly by the fact  
30 that the ignition device (4) strikes an object in the  
vicinity of the flare (2).

4.

A method according to claim 1, 2 or 3,

characterized in that the ignition device (4)  
is positioned within a trapping device (20) prior to the  
reaction of the ignition device (4).

5.

A method according to claim 1, 2, 3 or 4,  
c h a r a c t e r i z e d i n that the ignition device (4)  
5 may be propelled through the guidance tube (6) at a moderate  
speed, that it may optionally be stopped during its passage  
through the tube (6), and that it may optionally be reversed  
and returned back into the guidance tube (6) without a  
reaction taking place.

10

6.

An apparatus for the use of igniting combustible gases (1),  
for example from a flare (2) of a flare tower (3), by means  
of an ignition device (4) which is brought toward a region in  
15 or near a cloud of gas (1),

c h a r a c t e r i z e d b y a guidance tube (6) and a  
supply of a pressure medium, where the ignition device (4)  
is adapted for propulsion through the guidance tube (6) by  
means of the pressure medium for the purpose of bringing the  
20 ignition device (4) close to the cloud of gas (1) for a  
reaction near or within the cloud of gas (1).

7.

An apparatus according to claim 6,

25 c h a r a c t e r i z e d b y comprising a feeding unit  
(7), a control device (14) and, optionally, a magazine (8)  
for the ignition device (4).

8.

30 An apparatus according to claim 6 or 7,

c h a r a c t e r i z e d i n that an ignition initiator  
(13) is mounted somewhere along the guidance tube (6), said  
initiator (13) activating the ignition device (4) which,  
after a time delay, undergoes a reaction outside the tube, in  
35 or near the cloud of gas (1).

9.

An apparatus according to claim 6, 7 or 8,  
c h a r a c t e r i z e d i n t h a t i t c o m p r i s e s a t r a p p i n g  
device (20) for the ignition device (4) after the ignition  
5 device has left the tube (6).

10.

An ignition device to be used with the apparatus according to  
claims 6-9,

10 c h a r a c t e r i z e d i n t h a t i t i s i n t h e f o r m o f a n  
ignition pellet (4) which is electrically or mechanically  
activated, said ignition pellet (4) having a built-in delay  
prior to its reaction, the time for its activation and delay  
being predetermined and adapted to the particular flare and  
15 application.

20

25

30

35

## AMENDED CLAIMS

[received by the International Bureau on 19 March 1996 (19.03.96);  
original claims 1-10 replaced by amended claims 1-6 (2 pages)]

1.

A method for igniting combustible gases (1), for example from  
5 a flare (2) of a flare tower (3), where an ignition device  
(4) is launched in a direction toward a region of combustible  
gas (1), said ignition device (4) being propelled by means of  
a pressure medium through a guidance tube (6) to said gas  
10 cloud region (1), the ignition device (4) undergoing a  
reaction for the purpose of active ignition of the gas in  
said region, the time for its activation and reaction being  
predetermined and adapted to the particular flare and  
application, and the ignition device (4) being reacted in the  
15 form of a shower or cloud of sparks, where at least parts of  
the shower of sparks strike the gas cloud (1),  
c h a r a c t e r i z e d i n that the ignition device (4)  
is activated somewhere along its path in the tube (6),  
possibly at the moment when the ignition device (4) leaves  
the tube (6) or possibly when the ignition device (4) starts  
20 its course through the tube (6).

2.

A method according to claim 1,  
c h a r a c t e r i z e d i n that the ignition device (4)  
25 is positioned within a trapping device (20) prior to the  
reaction of the ignition device (4).

3.

A method according to claim 1 or 2,  
30 c h a r a c t e r i z e d i n that the ignition device (4)  
may be propelled at a moderate speed through the guidance  
tube (6), that it may optionally be stopped during its  
passage through the tube (6), and that it may optionally be  
reversed and returned back into the guidance tube (6) without  
35 a reaction taking place.

4.

An apparatus to be used for igniting combustible gases (1), for example from a flare (2) of a flare tower (3), by means of an ignition device (4) which is brought toward a region in or near a cloud of gas (1), comprising a guidance tube (6) and a supply of a pressure medium, where the ignition device (4) is adapted for propulsion through the guidance tube (6) by means of the pressure medium for the purpose of bringing the ignition device (4) close to the cloud of gas (1) for reaction near or within the cloud of gas (1), said device further comprising a feeding unit (7), a control device (14) and, optionally, a magazine (8) for the ignition device (4).  
c h a r a c t e r i z e d i n that an ignition initiator (13) is mounted somewhere along the guidance tube (6), said initiator (13) activating the ignition device (4) which, after a time delay, undergoes a reaction outside the tube, in or near the cloud of gas (1).

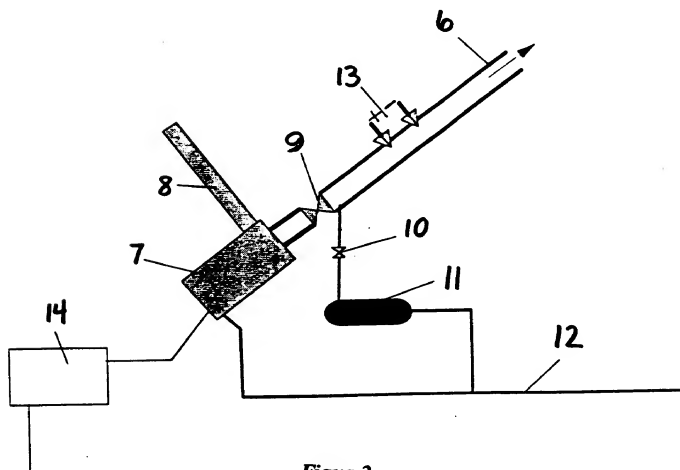
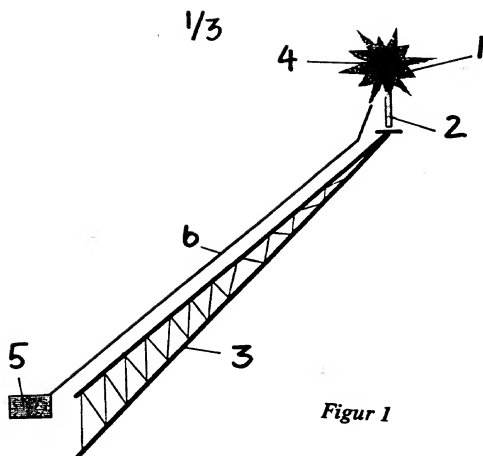
5.

An apparatus according to claim 4,  
c h a r a c t e r i z e d i n that it comprises a trapping device (20) for the ignition device (4) after the ignition device has left the tube (6).

6.

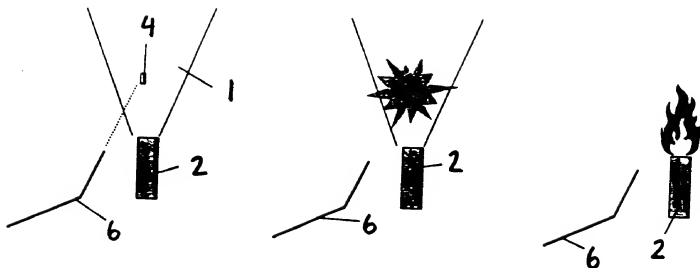
An ignition device to be used with the apparatus according to claims 4-5,

c h a r a c t e r i z e d i n that the ignition device is in the form of an ignition pellet (4) which is electrically or mechanically activated, said activation occurring somewhere along its path in the tube (6), possibly at the moment when the ignition pellet (4) leaves the tube (6), possibly when the ignition pellet (4) starts its course through the tube (6), said ignition pellet (4) having a built-in delay prior to its reaction, and the time for its activation and delay being predetermined and adapted to the particular flare and application.

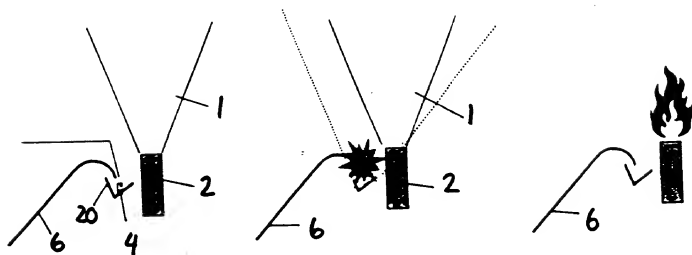




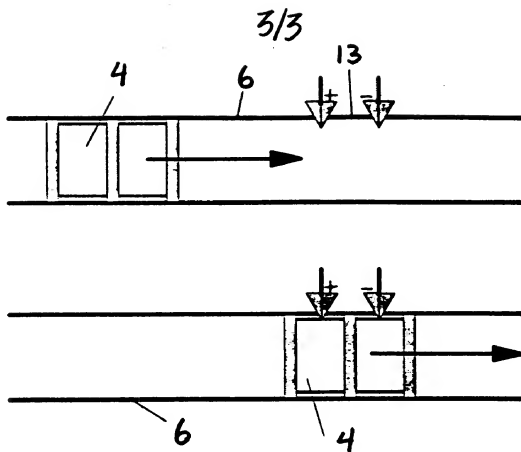
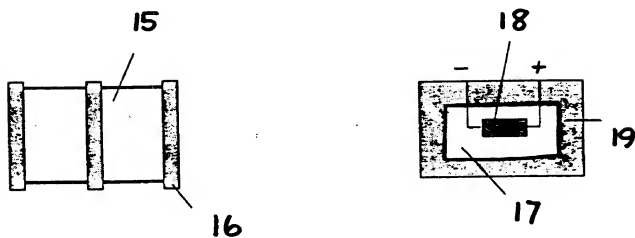
2/3



Figur 3



Figur 4

*Figur 5**Figur 6*

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 95/00183

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F23Q 13/00, F23G 7/08, F23Q 21/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F23G, F23Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 9429648 A1 (DEN NORSKE STATS OLJESELSKAP A.S.), 22 December 1994 (22.12.94), page 5, line 7 - page 8, line 26, figures 1,2 --	1-3,6,7
X	US 4449920 A (LEROUGE ET AL), 22 May 1984 (22.05.84), column 3, line 52 - column 4, line 34, figures 1,6, abstract	10
A	--	1,4,6
A	US 2696875 A (HENWOOD), 14 December 1954 (14.12.54), column 2, line 5 - line 71, figure 1 -- -----	1,4-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

\*&amp;\* document member of the same patent family

Date of the actual completion of the international search

17 January 1996

Date of mailing of the international search report

30-01-1996

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Anders Bruun  
Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

11/12/95

International application No.

PCT/NO 95/00183

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO-A1-	9429648	22/12/94	NONE		
US-A-	4449920	22/05/84	EP-A,B-	0069654	12/01/83
			FR-A,B-	2509020	07/01/83
			JP-A-	58045412	16/03/83
US-A-	2696875	14/12/54	NONE		